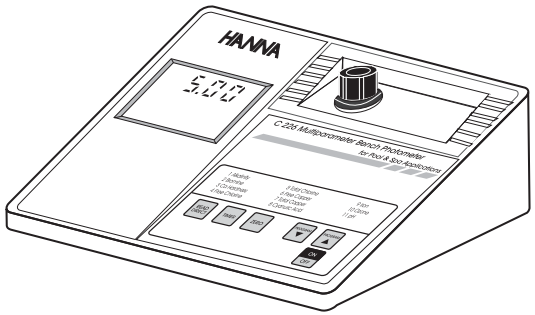
Instruction Manual

C 216 & C 226

Multiparameter Bench Photometers

for

Pool & Spa Applications



HANNA instruments

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CE

These Instruments are in Compliance with the CE Directives

Dear Customer,

Thank you for choosing a Hanna product. Please read this instruction manual carefully before using the meter. This manual will provide you with the necessary information for the correct use of the instrument. If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com. These instruments are in compliance with CE directives.

TABLE OF CONTENTS

PRELIMINARY EXAMINATION 3
GENERAL DESCRIPTION 3
ABBREVIATIONS 4
SIGNIFICANCE OF POOL AND SPA TESTING 5
SPECIFICATIONS 10
PRECISION AND ACCURACY 10
PRINCIPLE OF OPERATION 11
FUNCTIONAL DESCRIPTION 13
GUIDE TO DISPLAY CODES 14
TIPS FOR AN ACCURATE MEASUREMENT 17
PARAMETERS REFERENCE TABLES .. 19
OPERATIONAL GUIDE 20
ALKALINITY 22
BROMINE 24
CALCIUM HARDNESS 26
FREE CHLORINE 28
TOTAL CHLORINE 30
FREE COPPER 32
TOTAL COPPER 34
CYANURIC ACID 36
IRON 38
OZONE 40
pH 44
INTERFACE WITH PC 46
STANDARD METHODS 48
BATTERY REPLACEMENT 48
ACCESSORIES 49
CE DECLARATION OF CONFORMITY 50
WARRANTY 51
HANNA LITERATURE 51

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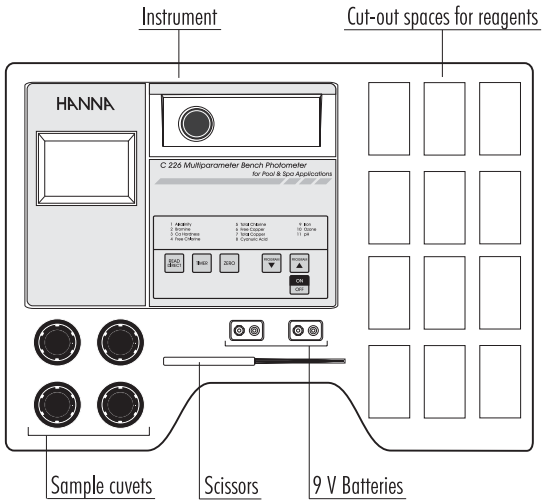
PRELIMINARY EXAMINATION

Please examine this product carefully. Make sure that the instrument is not damaged. If any damage occured during shipment, please notify your Dealer.

Each Meter is supplied complete with:

- Four Sample Cuvets and Caps
- Two 9V Batteries
- One pair of scissors
- Instruction Manual
- Rigid carrying case



Note: Save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing with the supplied accessories.

GENERAL DESCRIPTION

C 99 & C 200 Series is a line of 17 different bench, microprocessor-based photometers to measure more than 50 different parameters in water and wastewater. These multipurpose meters are manufactured to measure the most important parameters of the application they have been especially designed for:

C 99 Laboratories, with COD	C 200 Laboratories
C 203 Aquaculture	C 205 Boilers & Cooling Towers
C 206 Environmental Testing	C 207 Industrial Wastewater
C 208 Water Conditioning	C 209 Education
C 210 Pulp & Paper Mills	C 211 Chemical Manufacturers
C 212 Power Plant Utilities	C 213 Municipal Wastewater
C 214 Wastewater Treatment Applic.	C 215 Nutrient Analyses C 216 Pool & Spa Applic.
C 218 Environmental Applic.	C 226 Pool & Spa Applic.

All meters use an exclusive positive-locking system to ensure that the cuvet is in the same position every time it is placed into the measurement cell.

The reagents are in liquid or powder form and are supplied in bottles or in packets. The amount of reagent is precisely dosed to ensure the maximum repeatability.

Display codes aid the user in routine operations.

The meters have an auto-shut off feature that will turn off the instrument after 10 minutes of non-use.

The C 99 & C 200 Series can be connected to a personal computer via the HI 920010 three wire RS 232 cable. The HI 92000 Hanna Windows® Compatible Software aids the user to manage all test data.

ABBREVIATIONS

°C: degree Celsius

EPA: US Environmental Protection Agency

°F: degree Fahrenheit

g/L: grams per liter. g/L is equivalent to ppt (part per thoushand)

mg/L: milligrams per liter. mg/L is equivalent to ppm (part per million)

mL: milliliter

µg/L: micrograms per liter. µg/L is equivalent to ppb (part per billion)

SIGNIFICANCE OF POOL AND SPA TESTING

A major family leisure pursuit is the enjoyment of Swimming Pool and Spa facilities world-wide. A basic necessity of Pool water treatment, to ensure such enjoyment, is to maintain the water in a safe and pleasant condition for the bathers.

In order to achieve such an objective, swimming pool water requires testing on daily, and sometimes hourly bases for disinfection residuals and pH. Equally important, Calcium Hardness and Alkalinity parameters should be monitored on weekly bases to ensure the pool water is maintained in a balanced condition, thus to avoid system failure because of corrosion or scale formation.

DISINFECTION RESIDUAL AND pH CONTROL

In terms of swimming pool treatment, disinfection or sanitizing basically means to rid the pool of bather pollution, destroy bacteria, and control nuisance organisms like algae, which may occur in the pool, filtration equipment, and piping.

There are a number of techniques used, namely, chlorine, bromine and ozone dosing systems, of which chlorine is the most common.

Chlorine

Chlorine is a strong oxidizing agent that destroys mostly organic pollutants, bacteria and can combine with nitrogen containing compounds, forming chloramines. Only a part of the original quantity dosed chlorine, remains active and continues its disinfecting action.

From the **free chlorine** you can distinguish **combined chlorine**, as that part which combines with nitrogen containing compound and that is less efficient as a disinfectant. The addition of these two parts gives **total chlorine**. A pool manager needs to aim perfection where free equals total chlorine, and thus to maintain the combined chlorine concentration near zero. The presence of chloramines is not desired because of the distinctive 'swimming pool' smell caused by combined chlorines like di-chloramines. Beside this unpleasant odour it does irritate the eyes and the mucous membranes.

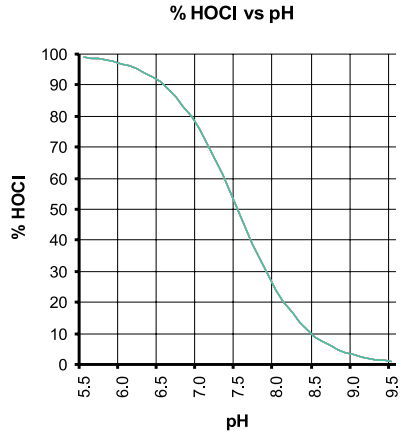
Commercially chlorine for disinfection may be available as a gas (Cl_2), a liquid like sodium hypochlorite or bleach (**NaOCl**) or in a solid state like calcium hypochlorite, chloro-hydantoins or chloro-cyanuric acid compounds.

These compounds, once dissolved in water do establish equilibrium

between the hypochlorous acid (**HOCl**) and the hypochlorite ions (OCl^-). Although both forms are considered free chlorine, it is the hypochlorous acid that provides the strongest disinfecting and oxidising characteristic of chlorine solutions.

The amount of hypochlorous acid in chlorinated water dependends upon the pH value of the solution. Changes in pH value will effect the HOCl equilibrium in relation to the hydrogen and hypochlorite ion.

As depicted by the curve below, HOCl decreases and OCl^- increases as pH increases. At a low pH, almost all the free chlorine is in the molecular form HOCl and at a pH of around 7.5, the ratio between HOCl and OCl^- is 50:50. Since the ionic form OCl^- is a slow acting sanitizer while the molecular HOCl is a fast acting, it is important to measure regularly the pH. As a general rule a pH of about 7.2 is recommended to maintain fast acting disinfection conditions.



Bromine

In many countries bromine sanitizing has been introduced as an alternative for chlorine, although it is a less strong sanitizer. The advantage of bromine is its stability at higher temperatures (advantageous for hot well pools), and its maintained disinfection power at higher pH. Further it does hardly react with nitrogen compounds, reducing the unpleasant odour, and eye irritation problems. The main disadvantage of bromine is the slower acting disinfecting power, making it less suitable for larger pools.

Ozone

Ozone is a very strong oxidizing agent that does destroy most difficult to oxidize organic compounds and chloramines. It thus allows the pool manager to remove very efficiently combined chlorine without refreshing

frequently large amounts of pool water. In general its application is found just before water passes through the filter units. Its sanitizing power is not pH related.

Mainly because of its strong oxidizing power the return water may contain only trace concentrations of ozone. It has to be mentioned that ozone is very unstable and there is anyway the need for low-level chlorination to ensure sanitizing throughout the whole pool.

THE WATER BALANCE AND LANGELIER INDEX (LI)

The pool water characteristics need to be maintained in a balanced condition to avoid system failure. Measuring the water balance is extremely important to predict if the water is corrosive, scaling or balanced.

A saturation index developed by Dr. Wilfred Langelier is widely used to predict the balance of swimming pool waters. It is an estimation of the solutions ability to dissolve or precipitate calcium carbonate deposits. A certain level of this precipitation (filming) is desired to insulate pipes and boilers from contact with water. When no protective filming is formed, water is considered to be corrosive. On the other hand scaling does cause failure because of incrustation problems.

In the treatment and monitoring of pool water, the pool manager must ensure that related parameters as alkalinity, hardness and pH are duly taken into consideration.

Calcium Hardness

The presents of calcium in the system is desired to ensure filming on those places where the temperature is relatively high, like in boilers and pipes transporting warm water. Scaling must be avoided because it reduces heat transfer and pump capacity. Beside the calcium carbonate deposits in the pipes, high scaling values do cause cloudy water.

It is recommended to maintain the calcium hardness value within the range from 200 to 400 ppm as calcium carbonate ($CaCO_3$).

Alkalinity

Alkalinity is the measure of the total concentration of alkaline substances, mostly bicarbonates, dissolved in the water. The higher the alkalinity the more resistant the water is to pH change, the alkalinity *buffers* the water. At the same time, high alkaline water is a major contributor to scaling problems like incrustation in filtration equipment, pumps, and piping.

It is recommended to maintain the alkalinity value within the range from 80 to 125 ppm as calcium carbonate ($CaCO_3$).

pH

The pH of the water is an important factor since at lower pH the corrosion

rate increases. If the alkalinity values are sufficiently high it will not be difficult to control the pH. Most pools managers do prefer to keep the pH between 7.2 and 7.4, that does ensure low corrosion rates and a sufficient activity of chlorine.

Langelier Index (LI)

The Langelier Index is a powerful tool to calculate the water balance, and to predict corrosion or scaling problems. Theoretically, a LI of zero indicates perfect water condition for swimming pools. If $LI > 0$, scaling and staining of the water is present, and if $LI < 0$ the water is corrosive and highly irritating. A tolerance of ± 0.4 is normally acceptable.

The Langelier formula is expressed as:

$$\mathbf{LI = pH + TF + HF + AF - 12.5}$$

where:

LI = Langelier Index (also called Saturation Index)
pH = pH of the water
TF = temperature factor
HF = hardness factor, log(Ca Hardness, ppm as $CaCO_3$)
AF = alkalinity factor, log(Alkalinity, ppm as $CaCO_3$)

To calculate the exact Langelier Index of your water please use the WATER INDEX reference tables at the end of this chapter to find the Temperature, Hardness and Alkalinity factors.

Recommendations

For most pools, water is balanced if:

- The pH value is maintained within the recommended ranges of **pH 7.2 - 7.6**
- Ideally the Alkalinity should be maintained within a range of **80 - 125 ppm**
- The Calcium Hardness should be maintained within a range of **200 - 400 ppm**.

To calculate your water balance three tests are required, measure the Calcium Hardness, the Alkalinity and the pH of the pool water. Find the **Hardness** and **Alkalinity Factor** in the WATER INDEX reference tables below.

The water temperature is in general controlled between 24°C (76°F) and 34°C (94°F) to ensure pleasant bather comfort. The **Temperature Factor** in this temperature range has minor importance; therefore an average value of 0.7 may be used**.**

A simple calculation classifies your water in corrosive, scaling, acceptable or ideal balanced, with treatment recommendations:

$$\mathbf{Water\ Balance = pH + TF + HF + AF}$$

Water Balance	Condition of Water	Recommendation
11.0 – 12.0	Corrosive	Increase pH and/or Alkalinity
12.1 – 12.3	Acceptable Balance	Retest water frequently
12.4 – 12.6	**Ideal Balance**	
12.7 – 12.9	Acceptable Balance	Retest water frequently
13.0 – 14.0	Scale forming	Reduce pH and/or alkalinity

WATER INDEX REFERENCE TABLES

Temperature			Calcium Hardness		Alkalinity	
°C	°F	TF	mg/L (as $CaCO_3$)	HF	mg/L (as $CaCO_3$)	AF
0	32	0	5	0.7	5	0.7
4	39	0.1	25	1.4	25	1.4
8	46	0.2	50	1.7	50	1.7
12	54	0.3	75	1.9	75	1.9
16	60	0.4	100	2.0	100	2.0
20	68	0.5	150	2.2	150	2.2
24	75	0.6	200	2.3	200	2.3
28	82	0.7	250	2.4	250	2.4
32	90	0.7	300	2.5	300	2.5
36	97	0.8	400	2.6	400	2.6
40	104	0.9	500	2.7	500	2.7
50	122	1.0	1000	3.0	1000	3.0

EXAMPLE:

Pool water conditions		Factor value (nearest values)
Temperature	30°C	TF = 0.7
pH	7.2	pH = 7.2
Alkalinity	80 mg/L	AF = 1.9
Hardness	230 mg/L	HF = 2.4

Water Balance = pH + TF + HF + AF
= 7.2 + 0.7 + 2.4 + 1.9 = **12.2**

Conclusion: the water is acceptable balanced but there is some risk that the water becomes corrosive; frequently testing is recommended.

The Hanna C216 and C226 are the ideal instruments to meet your monitoring requirements….

SPECIFICATIONS

Light Life	Life of the instrument
Light Detector	Silicon Photocell
Environment	0 to 50°C (32 to 122°F); max 90% RH non-condensing
Power Supply	2 x 9 V batteries / 12 to 20 VDC through voltage adapter (optional)
Auto-Shut off	After 10' of non-use
Dimensions	230 x 165 x 70 mm (9.0 x 6.5 x 2.8")
Weight	640 g (22.6 oz.)

For specifications related to each single parameter (e.g. range, precision, etc.), refer to the related measurement section.

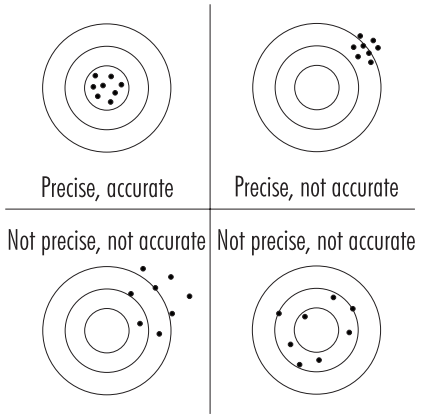
PRECISION AND ACCURACY

Precision is how closely repeated measurements agree with each other. Precision is usually expressed as standard deviation (SD).

Accuracy is defined as the nearness of a test result to the true value.

Although good precision suggests good accuracy, precise results can be inaccurate. The figure explains these definitions.

For each parameter, the precision is expressed in the related measurement section as standard deviation at a specific concentration value of the analite. The standard deviation is obtained with a single instrument using a representative lot of reagent.



PRINCIPLE OF OPERATION

Absorption of Light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices.

If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of substance according to the Lambert-Beer Law:

$$-\log \mathbf{I/I_o} = \varepsilon_\lambda \, c \, d$$

or

$$A = \varepsilon_\lambda \, c \, d$$

Where:

-log $\mathbf{I/I_o}$ = Absorbance (A)
$\mathbf{I_o}$ = intensity of incident light beam
$\mathbf{I}$ = intensity of light beam after absorption
ε_λ = molar extinction coefficient at wavelength λ
c = molar concentration of the substance
d = optical path through the substance

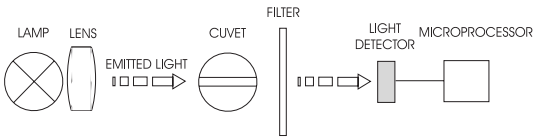
Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known.

Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents.

Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements.

The optical system of Hanna's C 99 & C 200 Series multiparameter photometers is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.

Four measuring channels (at four different wavelengths) allow a wide range of tests.



C 200 Series block diagram (optical layout)

A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed to the sample contained in the cuvet. The optical path is fixed by the diameter of the cuvet. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity I_0 or **I.**

The photoelectric cell collects the radiation **I** that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range.

The microprocessor uses this potential to convert the incoming value into the desired measuring unit and to display it on the LCD.

The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed.

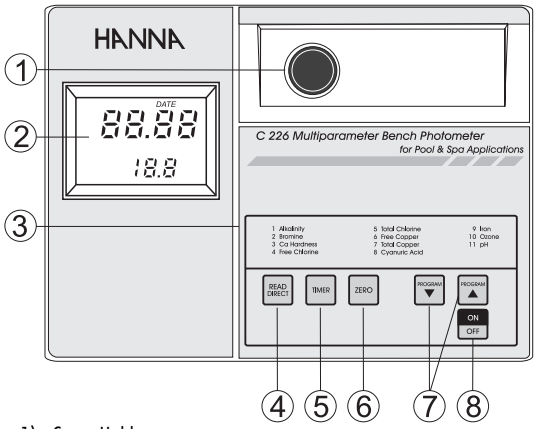
The cuvet has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvets are optically identical to provide the same measurement conditions. Whenever possible use the same cuvet for both.

It is necessary that the surface of the cuvet is clean and not scratched. This is to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvet walls with hands.

Furthermore, in order to maintain the same conditions during the zeroing and the measuring phases, it is necessary to close the cuvet to prevent any contamination.

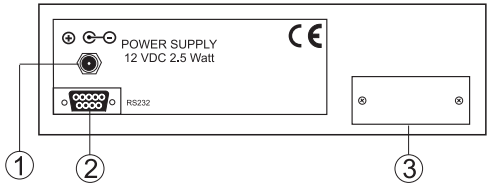
FUNCTIONAL DESCRIPTION

FRONT PANEL



1) Cuvet Holder
2) Dual Level Liquid Crystal Display (LCD)
3) Programs List
4) READ DIRECT, to perform measurement immediately
5) TIMER, to perform measurement after a preprogrammed countdown
6) ZERO, to zero the meter prior to measurement
7) Program ▼ and ▲, to select the desired parameter
8) ON/OFF, to turn the meter on and off

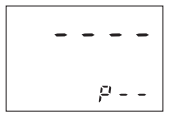
REAR PANEL



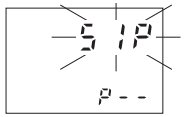
1) Power Supply 12 VDC 2.5 Watt
2) RS 232 Socket
3) Batteries Compartment

GUIDE TO DISPLAY CODES

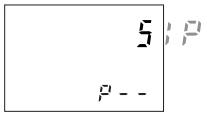
Note: The secondary LCD below shows a generic "P– –", whereas the meter will indicate the exact program number (e.g. in C 216, "P1" for Alkalinity).



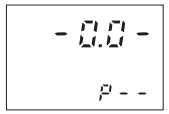
This indicates that the meter is in a ready state and zeroing can be performed.



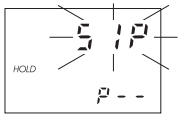
Sampling in progress. This flashing prompt appears each time the meter is performing a measurement.



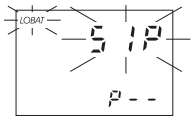
The microprocessor is adjusting the light level, indicated by a scrolling "SIP".



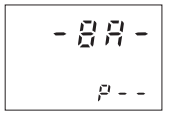
This indicates that the meter is in a zeroed state and measurement can be performed.



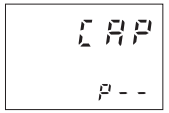
The instrument is performing an internal check-up.



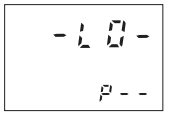
The blinking "LOBAT" indicates that the battery voltage is getting low and the batteries need to be replaced.



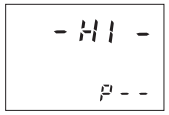
This indicates that the batteries are dead and must be replaced.



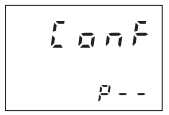
Light over range. The cuvet is not inserted correctly and an eccess ambient light is reaching the detector. If the cuvet is properly inserted, then contact your dealer or the nearest Hanna Customer Service Center.



The lamp is not working properly. Contact your dealer or the nearest Hanna Customer Service Center.



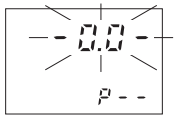
The lamp is not working properly. Contact your dealer or the nearest Hanna Customer Service Center.



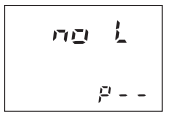
This indicates that the meter has lost its configuration. Contact your dealer or the nearest Hanna Customer Service Center.

ERROR MESSAGES

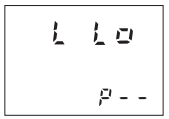
a) on zero reading:



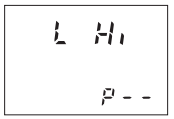
This indicates that the zeroing procedure failed due to a low signal-to-noise ratio. In this case press ZERO again.



The instrument cannot adjust the light level. Please check that the sample does not contain any debris.

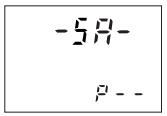


There is not enough light to perform a measurement. Please check the preparation of the zero cuvet.

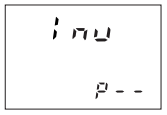


There is too much light to perform a measurement. Please check the preparation of the zero cuvet.

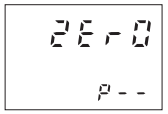
b) on sample reading:



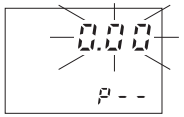
There is too much light for the sample measurement. Please check if the right sample cuvet is inserted.



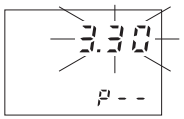
The sample and zero cuvet are inverted.



A zero reading was not taken. Follow the instruction described in the measurement procedures for zeroing the meter.



Under range. A blinking "0.00" indicates that the sample absorbs less light than the zero reference. Check the procedure and make sure that you use the same cuvet for reference (zero) and measurement.



1) A flashing value of the maximum concentration indicates an over range condition. The concentration of the sample is beyond the programmed range: dilute the sample and rerun the test.

2) A flashing value lower than the maximum concentration indicates a low signal-to-noise ratio condition. In this case accuracy of the result is not guaranteed. Repeat the reading procedure.

TIPS FOR AN ACCURATE MEASUREMENT

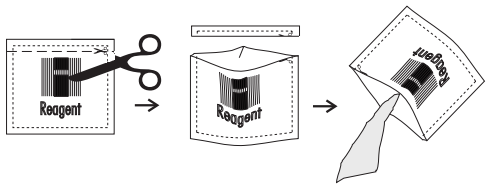
The instructions listed below should be carefully followed during testing to ensure best accuracy.

- Color or suspended matter in large amounts may cause interference, therefore, these should be removed by treatment with active carbon and by prior filtration.
- For a correct filling of the cuvet: the liquid in the cuvet forms a convexity on the top; the bottom of this convexity must be at the same level of the 10 mL mark.

- Proper use of the dropper:
  (a) to get good reproducible results, tap the dropper on the table for several times and wipe the outside of the dropper tip with a cloth.
  (b) always keep the dropper bottle in a vertical position while dosing the reagent.

(a) (b)

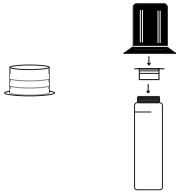
- Proper use of the powder reagent packet:
  (a) use scissors to open the powder packet;
  (b) push the edges of the packet to form a spout;
  (c) pour out the content of the packet.



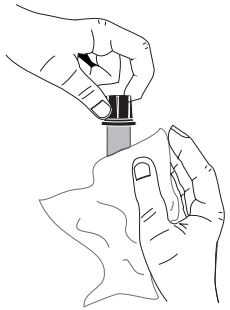
(a) (b) (c)

- It is important that the sample does not contain any debris. This would corrupt the reading.

- In order to avoid reagent leaking and to obtain more accurate measurements, it is recommended to close the cuvet first with the supplied HDPE plastic stopper and then with the black cap.



- Each time the cuvet is used, the cap must be tightened to the same degree.
- Whenever the cuvet is placed into the measurement cell, it must be dry outside, and completely free of fingerprints, oil or dirt. Wipe it thoroughly with **HI 731318** (tissue for wiping cuvets, see chapter ACCESSORIES) or a lint-free cloth prior to insertion.



- Shaking the cuvet can generate bubbles in the sample, causing higher readings. To obtain accurate measurements, remove such bubbles by swirling or by gently tapping the vial.
- Do not let the reacted sample stand too long after reagent is added, or accuracy will be lost.
- It is possible to take multiple readings in a row, but it is recommended to take a new zero reading for each sample and to use the same cuvet for zeroing and measurement.
- After the reading it is important to discard immediately the sample, otherwise the glass might become permanently stained.
- All the reaction times reported in this manual are referred to 20°C (68°F). As a general rule of thumb, they should be doubled at 10°C (50°F) and halved at 30°C (86°F).

PARAMETERS REFERENCE TABLES

C 216 - POOLMETER

Code	Parameter	Page
1	Alkalinity	22
2	Ca Hardness	26
3	Free Chlorine	28
4	Total Chlorine	30
5	Cyanuric Acid	36
6	pH	44

C 226 - POOLMETER

Code	Parameter	Page
1	Alkalinity	22
2	Bromine	24
3	Ca Hardness	26
4	Free Chlorine	28
5	Total Chlorine	30
6	Free Copper	32
7	Total Copper	34
8	Cyanuric Acid	36
9	Iron	38
10	Ozone	40
11	pH	44

OPERATIONAL GUIDE

POWER CONNECTION

Remove the battery cover on the back of the meter; attach 2 fresh 9V batteries and replace the cover.

Alternatively, plug the optional 12VDC adapter (**HI 710005** - 110VDC, or **HI 710006** - 220VDC) into the DC socket. Plug the adapter into the outlet.

Note: Insure the main line is surge protected.

Note: Always turn the meter off before unplugging it to insure no data is lost.

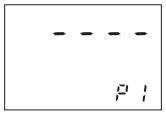
MEASUREMENT PROCEDURE

- Turn the meter on by pressing ON/OFF.

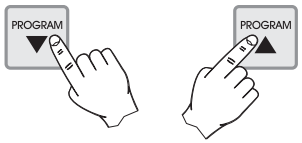
- The meter will first perform an LCD auto diagnostic test by displaying a full set of figures.

- Then it will show a scrolling "c --- Hanna Inst", whereas the meter will indicate the exact meter code (C 216 or C 226) .

- When the LCD displays "----", the meter is ready. On the secondary LCD "P1" will appear to inform that the first parameter measurement procedure (Alkalinity both for C 216 and C 226) can be performed.

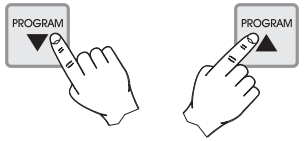


- Press the PROGRAM ▼ and PROGRAM ▲ keys to select the desired parameter.

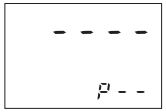


For the program number, see the parameters reference tables on page 19 or look at the list printed on the mask of the meter.

- After the desired program number appears on the secondary display, follow the measurement procedure described in the related chapter.
- Select a new parameter measurement procedure by pressing the



PROGRAM ▼ and PROGRAM ▲ keys.



Note: in the following measurement sections, a generic "P– –" will be placed on the secondary LCD instead of the exact related message (e.g. in C 226, "P2" for Bromine).

- Before performing a test read carefully all the instructions related to the selected parameter.

ALKALINITY

SPECIFICATIONS

Range	0 to 500 mg/L (as $CaCO_3$)
Resolution	5 mg/L
Precision	±10 @ 100 mg/L
Typical EMC Deviation	±5 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Colorimetric Method. At different alkalinity levels a distinctive range of colors from yellow to green and greenish blue will develop.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93755-0	Alkalinity Indicator Reagent	1 packet

REAGENT SETS

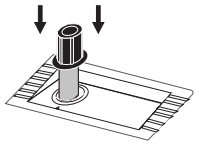
HI 93755-01 Reagents for 100 tests
HI 93755-03 Reagents for 300 tests
For other accessories see page 49.

MEASUREMENT PROCEDURE

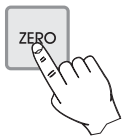
- Select the program number corresponding to Alkalinity on the secondary LCD by pressing PROGRAM ▼ and ▲.

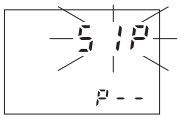
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

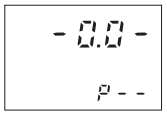


- Press ZERO and "SIP" will blink on the display.

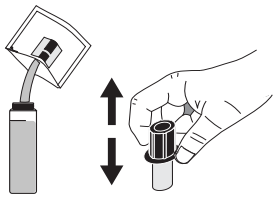




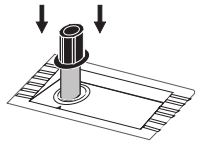
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



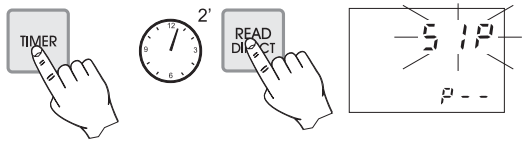
- Remove the cuvet.
- Add carefully the content of one packet of HI 93755-0 Alkalinity Indicator Reagent. Replace the cap and shake vigorously for 30 seconds.
  Note: Pay attention not to spill reagent otherwise full color development may be inhibithed.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays the **alkalinity in mg/L of $CaCO_3$** on the Liquid Crystal Display.

BROMINE

SPECIFICATIONS

Range	0.00 to 10.00 mg/L
Resolution	0.01 mg/L
Precision	±0.05 mg/L @ 2.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the *Standard Methods for the Examination of Water and Wastewater, 20th edition,* DPD method. The reaction between bromine and the reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93716-0	DPD Powder Reagent	1 packet

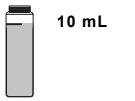
REAGENT SETS

HI 93716-01 Reagents for 100 tests
HI 93716-03 Reagents for 300 tests
For other accessories see page 49.

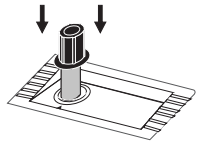
MEASUREMENT PROCEDURE

- Select the program number corresponding to Bromine on the secondary LCD by pressing PROGRAM ▼ and ▲.

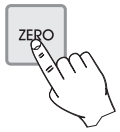
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

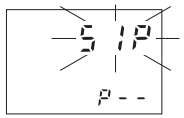


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

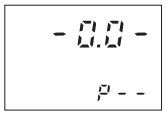


- Press ZERO and "SIP" will blink on the display.

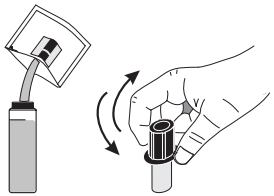




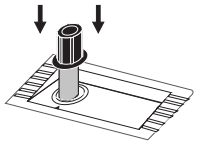
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



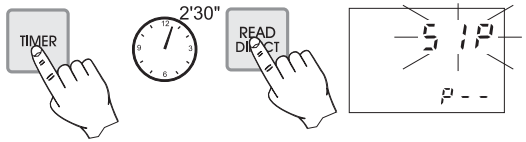
- Remove the cuvet.
- Add the content of one packet of HI 93716-0 Bromine Reagent. Replace the cap and shake gently for about 20 seconds to dissolve most of the reagent.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 2 minutes and 30 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of bromine** on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by: Chlorine, Chlorine Dioxide, Ozone.

In case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the reagent.

In case of water with alkalinity greater than 250 mg/L $CaCO_3$, the color of the sample may develop only partially, or may rapidly fade. To resolve this, neutralize the sample with diluted HCl.

CALCIUM HARDNESS

SPECIFICATIONS

Range	0 to 500 mg/L (as $CaCO_3$)
Resolution	5 mg/L
Precision	±10 mg/L @ 200 mg/L
Typical EMC Deviation	±5 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Colorimetric Method. The reaction between calcium and the reagents causes a violet to orange tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93756A-0	Calcium Indicator Reagent	1 packet
HI 93756B-0	Calcium Buffer Reagent	1 packet

REAGENT SETS

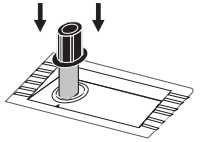
HI 93756-01 Reagents for 100 tests
HI 93756-03 Reagents for 300 tests
For other accessories see page 49.

MEASUREMENT PROCEDURE

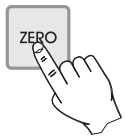
- Select the program number corresponding to calcium Hardness on the secondary LCD by pressing PROGRAM ▼ and ▲.

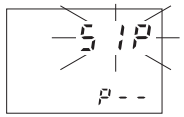
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

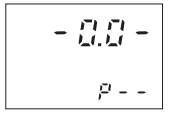


- Press ZERO and "SIP" will blink on the display.

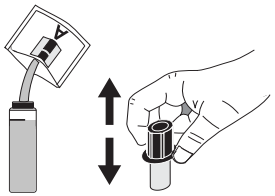




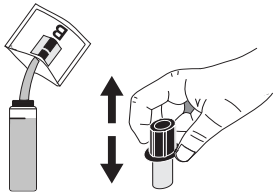
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



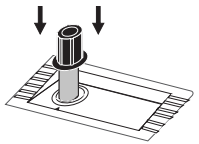
- Remove the cuvet.
- Add carefully the content of one packet of HI 93756A-0 Ca Hardness 1 Reagent. Replace the cap and shake vigorously for 10 seconds.
  Note: Pay attention not to spill reagent otherwise full color development may be inhibithed.



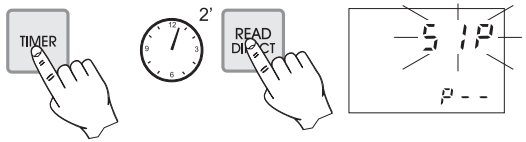
- Add the content of one packet of HI 93756B-0 Ca Hardness 2 Reagent. Replace the cap and shake vigorously for 10 seconds.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of calcium as $CaCO_3$** on the Liquid Crystal Display.
- To convert the result to mg/L of calcium (Ca^{2+}), multiply by a factor of 0.4.

INTERFERENCES

Interference may be caused by:

Orthophosphate: precipitate Calcium at the pH of the test.

Alkalinity above 150 mg/L $CaCO_3$ may cause cloudiness. To resolve this, neutralize the sample with diluted HCl.

FREE CHLORINE

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L from 0.00 to 2.50 mg/L; 0.10 mg/L above 2.50 mg/L
Precision	±0.03 mg/L @ 1.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the USEPA method 330.5 and *Standard Methods for the Examination of Water and Wastewater, 20th edition,* 4500-Cl G. The reaction between free chlorine and the DPD reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93701-0	DPD Powder Reagent	1 packet

REAGENT SETS

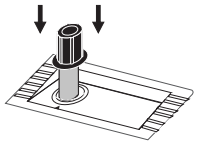
HI 93701-01 Reagents for 100 tests
HI 93701-03 Reagents for 300 tests
For other accessories see page 49.

MEASUREMENT PROCEDURE

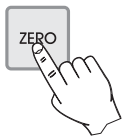
- Select the program number corresponding to Free Chlorine on the secondary LCD by pressing PROGRAM ▼ and ▲.

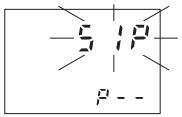
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

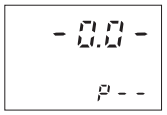


- Press ZERO and "SIP" will blink on the display.

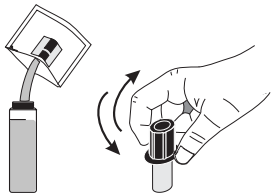




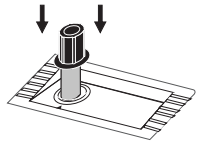
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



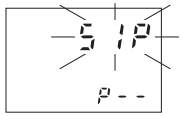
- Remove the cuvet.
- Add the content of one packet of HI 93701-0 Free Chlorine Reagent. Replace the cap and shake gently for 20 seconds.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Wait for 1 minute and press READ DIRECT. "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of free chlorine** on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by: Bromine, Chlorine Dioxide, Iodine, Ozone (all these interferences give positive errors).

Alkalinity above 250 mg/L $CaCO_3$ will not reliably develop the full amount of color or it may rapidly fade. To resolve this, neutralize the sample with diluted HCl.

In case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the powder reagent.

TOTAL CHLORINE

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L from 0.00 to 2.50 mg/L; 0.10 mg/L above 2.50 mg/L
Precision	±0.03 mg/L @ 1.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the EPA method 330.5 and *Standard Methods for the Examination of Water and Wastewater, 20th edition,* 4500-Cl G. The reaction between chlorine and the DPD reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93711-0	DPD Powder Reagent	1 packet

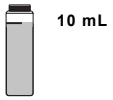
REAGENT SETS

HI 93711-01 Reagents for 100 tests
HI 93711-03 Reagents for 300 tests
For other accessories see page 49.

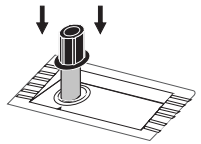
MEASUREMENT PROCEDURE

- Select the program number corresponding to Total Chlorine on the secondary LCD by pressing PROGRAM ▼ and ▲.

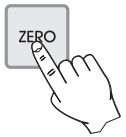
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

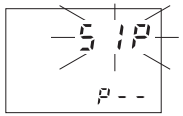


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

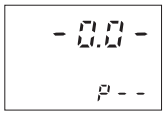


- Press ZERO and "SIP" will blink on the display.

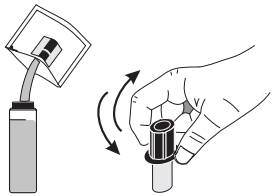




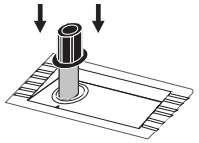
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



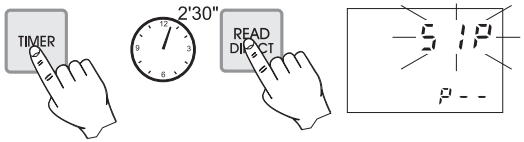
- Remove the cuvet.
- Add the content of one packet of HI 93711-0 Total Chlorine Reagent. Replace the cap and shake gently for 20 seconds



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 2 minutes and 30 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of total chlorine** on the Liquid Crystal Display.

INTERFERENCES

Interference may be caused by: Bromine, Chlorine Dioxide, Iodine, Ozone (all these interferences give positive errors).

Alkalinity above 250 mg/L $CaCO_3$ will not reliably develop the full amount of color or it may rapidly fade. To resolve this, neutralize the sample with diluted HCl.

In case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the powder reagent.

FREE COPPER

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L
Precision	±0.03 mg/L @ 1.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the USEPA approved method. The reaction between free copper and the bicinchoninate reagent causes a purple tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93702-0	Bicinchoninate	1 packet

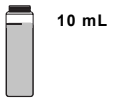
REAGENT SETS

HI 93702-01 Reagents for 100 tests
HI 93702-03 Reagents for 300 tests
For other accessories see page 49.

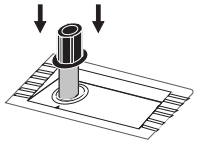
MEASUREMENT PROCEDURE

- Select the program number corresponding to Free Copper on the secondary LCD by pressing PROGRAM ▼ and ▲.

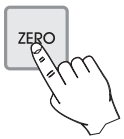
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

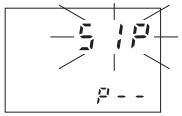


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

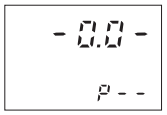


- Press ZERO and "SIP" will blink on the display.

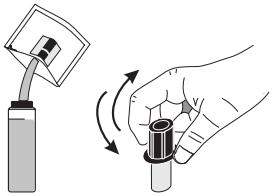




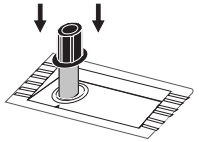
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



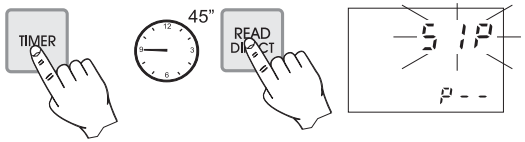
- Remove the cuvet.
- Add the content of one packet of HI 93702-0 Copper Reagent. Replace the cap and shake gently for 15 seconds.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 45 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of free copper on** the Liquid Crystal Display.

TOTAL COPPER

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L
Precision	±0.03 mg/L @ 1.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 575 nm
Method	Adaptation of the USEPA approved method. The reaction between free copper and the bicinchoninate reagent causes a purple tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93702-0	Bicinchoninate	1 packet
HI 93702T-0	Decomplexing Agent	1 packet

REAGENT SETS

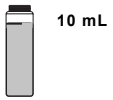
HI 93702T-01 Reagents for 100 tests
HI 93702T-03 Reagents for 300 tests

For other accessories see page 49.

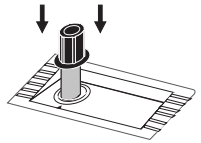
MEASUREMENT PROCEDURE

- Select the program number corresponding to Total Copper on the secondary LCD by pressing PROGRAM ▼ and ▲.

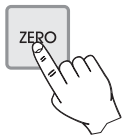
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

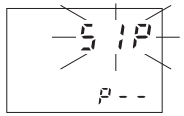


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

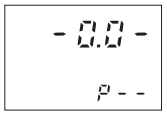


- Press ZERO and "SIP" will blink on the display.

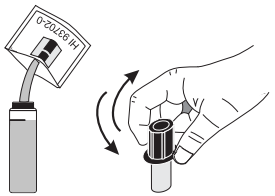




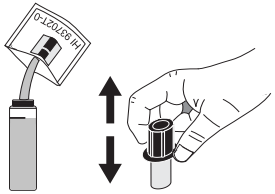
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



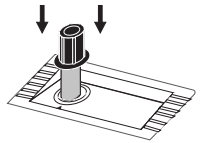
- Remove the cuvet.
- Add the content of one packet of HI 93702-0 Copper Reagent. Replace the cap and shake gently for 15 seconds.



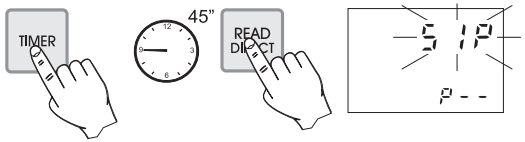
- Add the content of one packet of HI 93702T-0 Copper Total Reagent. Replace the cap and shake vigorously for 15 seconds.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 45 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of total copper** on the Liquid Crystal Display.

CYANURIC ACID

SPECIFICATIONS

Range	0 to 200 mg/L
Resolution	1 mg/L from 0 to 100 mg/L; 10 mg/L above 100 mg/L
Precision	±5 mg/L @ 60 mg/L
Typical EMC Deviation	±1 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Turbidimetric method. The reaction between cyanuric acid and the reagent causes a white turbidity in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93722-0	Cyanuric Acid Reagent	1 packet

REAGENT SETS

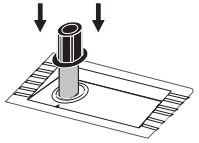
HI 93722-01 Reagents for 100 tests
HI 93722-03 Reagents for 300 tests
For other accessories see page 49.

MEASUREMENT PROCEDURE

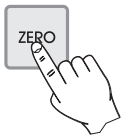
- Select the program number corresponding to Cyanuric Acid on the secondary LCD by pressing PROGRAM ▼ and ▲.

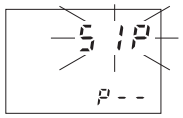
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

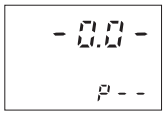


- Press ZERO and "SIP" will blink on the display.

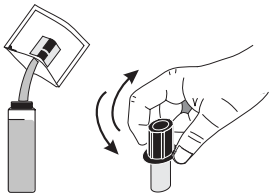




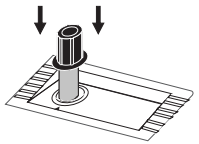
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



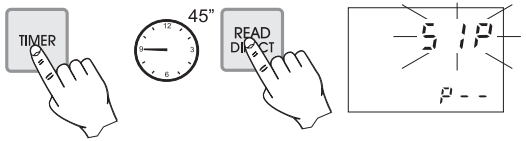
- Remove the cuvet.
- Add the content of one packet of HI 93722-0 Cyanuric Acid Reagent. Replace the cap and shake gently for about 10 seconds (dissolution is not complete).



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 45 seconds and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in **mg/L of cyanuric acid** on the Liquid Crystal Display.

INTERFERENCES

Turbidity preexisting in the sample causes interference during measurement.

IRON

SPECIFICATIONS

Range	0.00 to 5.00 mg/L
Resolution	0.01 mg/L
Precision	±0.02 mg/L @ 1.50 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the EPA method 315B and *Standard Methods for the Examination of Water and Wastewater, 20th edition,* 3500-Fe B. The reaction between iron and the phenantroline reagent causes an orange tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93721-0	Iron High Range Reagent	1 packet

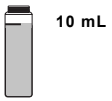
REAGENT SETS

HI 93721-01 Reagents for 100 tests
HI 93721-03 Reagents for 300 tests
For other accessories see page 49.

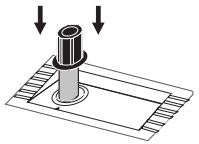
MEASUREMENT PROCEDURE

- Select the program number corresponding to Iron on the secondary LCD by pressing PROGRAM ▼ and ▲.

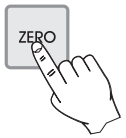
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

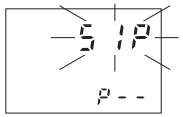


- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

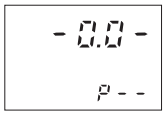


- Press ZERO and "SIP" will blink on the display.

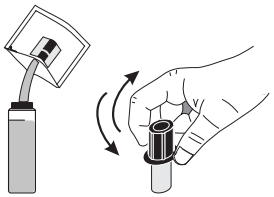




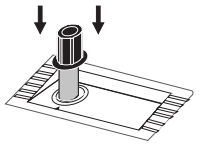
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



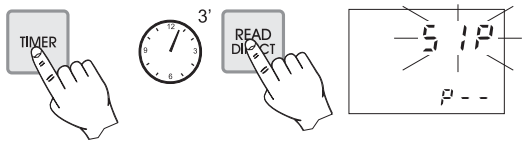
- Remove the cuvet.
- Add the content of one packet of HI 93721-0 Iron High Range Reagent. Replace the cap and shake until dissolution is complete.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 3 minute and press READ DIRECT. In both cases "SIP" will blink during measurement.
  Note: for the majority of samples a reading may be taken already after 1 minute, because color development in the sample is in general very fast (full color development within 1 minute).



- The instrument directly displays concentration in **mg/L of iron** on the Liquid Crystal Display.

INTERFERENCES

Copper does not interfere: reagent contains a masking agent.

OZONE

SPECIFICATIONS

Range	0.00 to 2.00 mg/L
Resolution	0.01 mg/L
Precision	±0.03 mg/L @ 1.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Colorimetric DPD Method. The reaction between ozone and the DPD reagent causes a pink tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93757-0	DPD Powder Reagent	1 packet
HI 93703-52-0	Glycine Powder (Optional Reagent)	1 packet

REAGENT SETS

HI 93757-01	Reagents for 100 tests
HI 93757-03	Reagents for 300 tests
HI 93703-52	Glycine Powder, Optional Reagent for 100 tests

For other accessories see page 49.

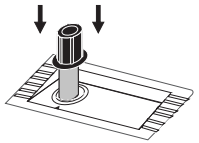
IMPORTANT NOTE: chlorine is a strong positive interference for the ozone determination. If the sample is suspected to contain chlorine residues (free or total chlorine), please follow the **alternative** measurement procedure described below:

- Perform the Standard Measurement Procedure and take note of the reading: *value A*.
- On a fresh sample perform the Additional Measurement Procedure and take note of the reading: *value B*.
- Subtract reading *B* from reading *A* to obtain the ozone concentration in mg/L:
  mg/L (O_3) = *value A* – *value B*.

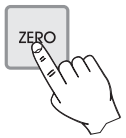
STANDARD MEASUREMENT PROCEDURE

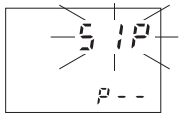
- Select the program number corresponding to Ozone on the secondary LCD by pressing PROGRAM ▼ and ▲.
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

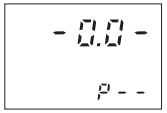


- Press ZERO and "SIP" will blink on the display.

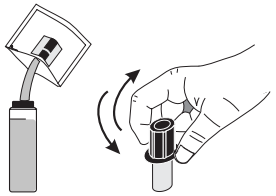




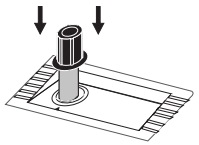
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



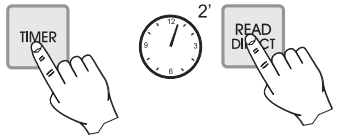
- Remove the cuvet.
- Add the content of one packet of HI 93757-0 Ozone Reagent. Replace the cap and shake gently for 20 seconds.

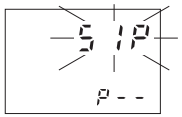


- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.





- The instrument directly displays concentration in **mg/L of ozone** on the Liquid Crystal Display (chlorine free samples only).

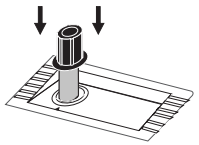
ADDITIONAL MEASUREMENT PROCEDURE

For samples containing chlorine

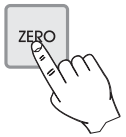
- Select the program number corresponding to Ozone on the secondary LCD by pressing PROGRAM ▼ and ▲.

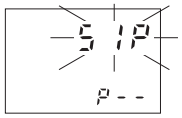
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

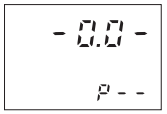


- Press ZERO and "SIP" will blink on the display.



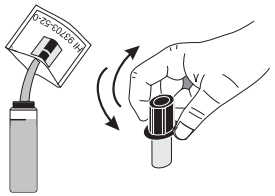


- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.

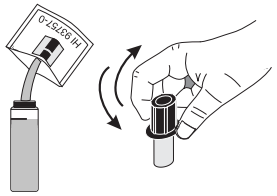


- Remove the cuvet.

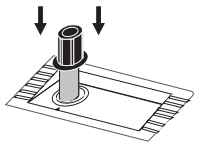
- Add the content of one packet of the optional reagent HI 93703-52-0 Glycine Powder. Replace the cap and shake gently until dissolution is complete.



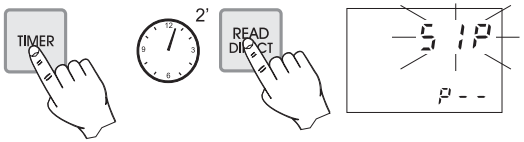
- Add the content of one packet of HI 93757-0 Ozone Reagent. Replace the cap and shake gently for 20 seconds.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press TIMER and the display will show the countdown prior to measurement. Alternatively, wait for 2 minutes and press READ DIRECT. In both cases "SIP" will blink during measurement.



- The instrument directly displays a concentration value refering to chlorine interference, on the Liquid Crystal Display. Subtract this value from the reading from the Standard Measurement Procedure: this will be the concentration in **mg/L of ozone** in the sample.

INTERFERENCES

Interference may be caused by: Bromine, Chlorine Dioxide, Iodine.

Alkalinity above 250 mg/L $CaCO_3$ will not reliably develop the full amount of color or it may rapidly fade. To resolve this, neutralize the sample with diluted HCl.

In case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the powder reagent.

pH

SPECIFICATIONS

Range	6.5 to 8.5 pH
Resolution	0.1 pH
Precision	±0.1 pH
Typical EMC Deviation	±0.1 pH
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Method	Adaptation of the Phenol Red method. The reaction between the sample and the reagent causes a yellow to a red tint in the sample.

REQUIRED REAGENTS

Code	Description	Quantity/test
HI 93710-0	Phenol Red Indicator	1 packet

REAGENT SETS

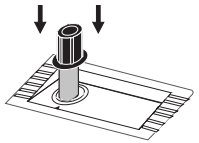
HI 93710-01 Reagents for 100 tests
HI 93710-03 Reagents for 300 tests
For other accessories see page 49.

MEASUREMENT PROCEDURE

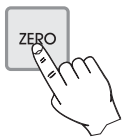
- Select the program number corresponding to pH on the secondary LCD by pressing PROGRAM ▼ and ▲.

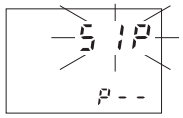
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.

- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.

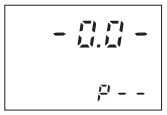


- Press ZERO and "SIP" will blink on the display.

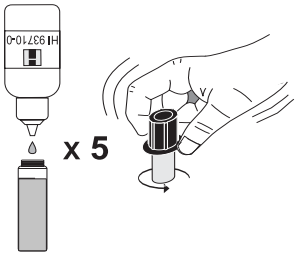




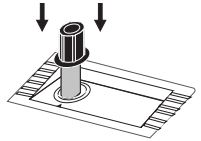
- Wait for a few seconds and the display will show "-0.0-". Now the meter is zeroed and ready for measurement.



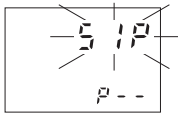
- Remove the cuvet.
- Add 5 drops of HI 93710-0 pH Reagent. Replace the cap and swirl the cuvet.



- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



- Press READ DIRECT and "SIP" will blink during measurement.



- The instrument directly displays the pH measured value on the Liquid Crystal Display.

INTERFACE WITH PC

To connect your meter to the PC use the optional **HI 920010** (available from your Hanna Dealer). Make sure that your meter is switched off and plug the connectors, one into the meter RS 232C socket, the other into the serial port of your PC.

Note: Cables other than **HI 920010** may use a different configuration, in which case, communication between the meter and the PC may not be possible.

SETTING THE BAUD RATE

The transmission speed (baud rate) of the meter and the external device must be identical. The meter is factory set to 2400.

If you wish to change this value, please contact your nearest Hanna Center.

SENDING COMMANDS FROM PC

With terminal programs such as, for example, Telix®, Windows Terminal®, it is possible to remotely control your Hanna Instruments bench meter. Use **HI 920010** cable to connect the meter to the PC, start the terminal program and set the communication options as follows: 8, N, 1, no flow control.

Command Types

To send a command to the meter the scheme is:

<DLE> <*command*> <CR>

This line makes the computer send a Data Link Escape character (/ or ?), the command expressed as a number or a 3-character sequence and a CR character.

Note: Windows Terminal® and all the other terminal programs that support the ANSI escape sequence, represent the DLE character by the string '^P' and the CR character by the string '^M'.

Type of Commands

/OFF - Turn the meter OFF

/PDR - Press Read Direct

/PTR - Press Timer

/PZR - Press Zero

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Lotus 1-2-3© Copyright of "Lotus Co."
TELIX® is registered Trademark of "Deltacomm"
Windows® and Windows Terminal® are registered Trademark of "Microsoft Co."

/PUP - Program Up

/PDN - Program Down

/PTM - Turn Test Mode On

/Brx - Set the baud rate

1 - 300	2 - 600
3 - 1200	4 - 2400

/KBL - Lock Keyboard

/KBU - Unlock Keyboard

?PR# - Send Current Program Number

?BRQ - Send current baud rate

1 - 150	2 - 300
3 - 600	4 - 1200
5 - 2400	

?CNQ - Send Concentration (three bytes)

conc

decimal point

unit

m - ppm	b - ppb
t - ppt	u - pcu
h - pH	

?ERR - send error / status information

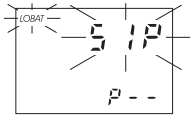
0 - No error
1 - CAP
2 - HI
3 - ZERO
4 - LO
5 - IDLE
6 - ZERO DONE
7 - TIMED READ

STANDARD METHODS

Description	Range	Method
Alcalinity	0 to 500 mg/L	Colorimetric
Bromine	0.00 to 10.00 mg/L	DPD
Calcium Hardness	0 to 500 mg/L	Colorimetric
Chlorine, Free	0.00 to 5.00 mg/L	DPD
Chlorine, Total	0.00 to 5.00 mg/L	DPD
Copper, Free	0.00 to 5.00 mg/L	Bicinchoninate
Copper, Total	0.00 to 5.00 mg/L	Bicinchoninate
Cyanuric Acid	0 to 200 mg/L	Turbidimetric
Iron	0.00 to 5.00 mg/L	Phenantroline
Ozone	0.00 to 2.00 mg/L	DPD
pH	6.5 to 8.5 pH	Phenol Red

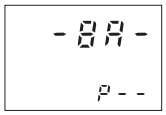
BATTERY REPLACEMENT

To prolong battery life, switch your meter off after use. However, the meter has an auto-shut off feature that will turn itself off after 10 minutes of non-use.



A blinking "LOBAT" on the display, while a measurement is in progress, indicates low voltage and the batteries should be replaced.

If the batteries are not replaced immediately, in order to prevent erroneous readings due to low voltage, "-BA-" is displayed soon afterwards. At this point the batteries must be changed.



Battery replacement must only take place in a non-hazardous area using two 9V alkaline batteries.

Remove the battery cover on the back of photometer, attach two fresh 9V batteries, while paying attention to the correct polarity, and replace the cover.

The meter will turn on automatically when a new battery is connected. You can turn it off by pressing ON/OFF.

Besides to 9V batteries, these meters can also be fed by the optional 12 to 20 VDC through voltage adapter.

ACCESSORIES

REAGENT SETS

HI 93701-01	100 free chlorine tests (powder)
HI 93701-03	300 free chlorine tests (powder)
HI 93702-01	100 free copper tests
HI 93702-03	300 free copper tests
HI 93702T-01	100 total copper tests
HI 93702T-03	300 total copper tests
HI 93703-52	100 glycine powder packets (optional reagent)
HI 93710-01	100 pH tests
HI 93710-03	300 pH tests
HI 93711-01	100 total chlorine tests (powder)
HI 93711-03	300 total chlorine tests (powder)
HI 93716-01	100 bromine tests
HI 93716-03	300 bromine tests
HI 93721-01	100 iron tests
HI 93721-03	300 iron tests
HI 93722-01	100 cyanuric acid tests
HI 93722-03	300 cyanuric acid tests
HI 93755-01	100 alkalinity tests
HI 93755-03	300 alkalinity tests
HI 93756-01	100 calcium hardness tests
HI 93756-03	300 calcium hardness tests
HI 93757-01	100 ozone tests
HI 93757-03	300 ozone tests

OTHER ACCESSORIES

C115-00300	5 mL graduated syringe
HI 710005	110VAC to 12VDC voltage adapter
HI 710006	220VAC to 12VDC voltage adapter
HI 721310	9V battery (10 pcs)
HI 731318	Tissue for wiping cuvets (4 pcs)
HI 731321	Glass cuvets (4 pcs)
HI 731325N	New cap for cuvet (4 pcs)
HI 740034	Cap for 100 mL beaker (6 pcs)
HI 740036	100 mL plastic beaker (6 pcs)
HI 740038	60 mL glass bottle and stopper
HI 740142	1 mL graduated syringe
HI 740143	1 mL graduated syringe (6 pcs)
HI 740144	Pipette tip (6 pcs)
HI 740157	Plastic refilling pipette (20 pcs)
HI 740220	25 mL glass cylinders with caps (2 pcs)
HI 92000	Windows® Compatible Software
HI 920010	PC connection cable
HI 93703-50	Cuvets cleaning solution (230 mL)

CE DECLARATION OF CONFORMITY

HANNA instruments

CE

DECLARATION OF CONFORMITY

We

Hanna Instruments Italia Srl
Viale Delle Industrie, 12/A
35010 Villafranca Padovana- PD
ITALY

herewith certify that the Ion Specific Multiparameter Photometers:

C 216 C 226

Has been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 50082-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 61000-4-2 Electrostatic Discharge
IEC 61000-4-3 RF Radiated

EN 50081-1: Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory us

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A. Marsilio - Engineering Manager
On behalf of
Hanna Instruments Italia S.r.l.

Recommendations for Users

Before using these products, make sure that they are entirely suitable for your specific application and for the environment in which they are used.

Operation of these instruments may cause unacceptable interferences to other electronic equipments, this requiring the operator to take all necessary steps to correct interferences.

Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance.

To avoid damages or burns, do not put the instrument in microwave ovens. For yours and the instrument safety do not use or store the instrument in hazardous environments.

WARRANTY

All Hanna Instruments meters are warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions.

This warranty is limited to repair or replacement free of charge.

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact your dealer. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred.

If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service Department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

HANNA LITERATURE

Hanna publishes a wide range of catalogs and handbooks for an equally wide range of applications. The reference literature currently covers areas such as:

- Water Treatment
- Process
- Swimming Pools
- Agriculture
- Food
- Laboratory

and many others. New reference material is constantly being added to the library.

For these and other catalogs, handbooks and leaflets contact your dealer or the Hanna Customer Service Center nearest to you. To find the Hanna Office in your vicinity, check our home page at www.hannainst.com.

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HANNA instruments

www.hannainst.com